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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 15 1987

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Alachlor(090501) - Response to Registration Standard
EPA Reg. No. 524-316
Residue data on Dry Beans, Succulent Beans, Cottonseed, Sunflower Seeds, and Peanut Processing Study; Monsanto Report Numbers:
MSL-6218 (Succulent Peas and Beans) December, 1986
MSL-6224 (Dry Peas and Beans) December, 1986
MSL-6201 (Sunflower Seeds, Meal & Oil) December, 1986
MSL-6185 (Cottonseed) December, 1986
MSL-6100 (Peanut Processing Study) December, 1986
[MRID Nos. 400399-01, 400403-01, 400401-01, 400403-01, 400404-01; RCB Nos. 1828 through 1833]

FROM: Susan V. Hummel, Chemist
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Susan V. Hummel

THRU: Charles L. Trichilo, Branch Chief
Residue Chemistry Branch
Hazard Evaluation Division (TS-769)

TO: Vicky Walters, PM#25
Herbicide Fungicide Branch
Registration Division (TS-767)

and

David Giamporcaro
Special Review Branch
Registration Division (TS-767)

Monsanto Company has submitted a response to the Alachlor Registration Standard consisting of residue data for alachlor residues on succulent and dry bean commodities; sunflower seeds, meal with hulls, and oil; cottonseeds; and peanut processed commodities (crude and refined oils, meal, soapstock, and protein concentrates and isolates). Alachlor [2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide] is the active ingredient in LASSO Herbicide.

The Alachlor Registration Standard was issued 11/20/84. Alachlor was placed into Special Review in December, 1984. The Alachlor PD2/3 was issued in September, 1986.

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According to the the Registration Standard, the available residue data did not support the established tolerances on any rac, since a second class of alachlor metabolites was discovered in a plant metabolism study on corn and soybeans (M. Kovacs, PP#0F2348, 4/23/84, Accession No. 251375). Previous residue methodology had detected only those metabolites which contained the diethylaniline moiety (DEA). This method (for corn and soybeans) was the subject of a recent method tryout (MTO). The DEA method has failed the MTO, due to a large range of recoveries, a large c.o.v., the need for custom made glassware, and lack of availability of the analytical standards (F. D. Griffith, 1/15/86). Monsanto has since developed similar methods using the same piece of custom made glassware to detect those metabolites containing the hydroxyethylethylaniline moiety (HEEA) in various commodities and also a method not requiring the use of custom-made glassware.

Tolerances have been established for the combined residues of alachlor and its metabolites in or on numerous commodities, ranging from 0.02 ppm (N) in animal commodities to 3 ppm in or on peanut forage. (40 CFR 180.249). These tolerances are tabulated below. No food or feed additive tolerances for residues of alachlor and its metabolites have been established. The tolerance for peas with pods removed should be revised to "peas," i.e., peas <u>with</u> pods.

Commodity	Tolerance (ppm).
Beans, field, dry	0.1(N)
Beans, forage & hay	0.2(N)
Corn, forage & fodder	0.2(N)
Corn, fresh (incl. sweet, K + CWHR)	0.05(N)
Corn, grain	0.2(N)
Cotton, forage	0.2(N)
Cottonseed	0.05(N)
Lima beans, green	0.1(N)
Peanuts	0.05(N)
Peanut Hulls	1.5
Peanuts, forage & hay	3
Peas, forage & hay	0.2(N)
Peas w/pods removed	0.1(N)
Potatoes	0.1(N)
Sorghum, fodder & forage	1
Sorghum, grain (milo)	0.1
Soybeans	0.2(N)
Soybeans, forage	0.75
Soybeans, hay	0.2(N)
Sunflower seeds	0.25

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Commodity	Tolerance (ppm).
Meat, fat, and meat byp of cattle, goats, hogs, horses, poultry, and sheep; milk; and eggs	0.02(N)

The designation "(N)" means negligible residue; i.e., the tolerance was set at the limit of detection of the analytical method.

This submission includes the following studies:

"Alachlor Residues from Two Metabolite Classes in Succulent Peas, Lima Beans, and Snap Beans," S. A. Adams, Monsanto Report No. MSL-6218, December 24, 1986. EPA MRID No. 400399-01.

"Alachlor Residues from Two Metabolite Classes in Dry Peas, and Dry Lima, Navy, Pinto, and Red Kidney Beans," S. A. Adams, Monsanto Report No. MSL-6224, December 24, 1986. EPA MRID No. 400403-01.

"Determination of Alachlor Residues in Sunflower Seeds, Crude Oil, and Meal with Hulls," R. Lauer and L. M. Horner, Monsanto Report No. MSL-6201, December 24, 1986. EPA MRID No. 400401-01.

"Alachlor Residues from Two Metabolite Classes in Cottonseed Following Preemergent Application or Preplant Incorporation of Lasso Herbicide," (Interim report) J. A. Graham, Monsanto Report No. MSL-6185, December 24, 1986. EPA MRID No. 400402-01.

"Alachlor Residues from Two Metabolite Classes in Peanuts, Peanut Protein and Peanut Oil Fractions," M. A. Marshall and D. D. Arras, Monsanto Report No. MSL-6100, EPA MRID No. 400404-01.

Previously submitted residue data and protocols have been discussed in the following reviews.

January 30, 1987, Susan V. Hummel (SVH) to David Giamporcaro (DG) and Vicky Walters (VW), Monsanto MSL-5678 (aka MSL-5603), MSL-5702 (aka MSL-5534), MSL-5718 (aka MSL-4636), MSL-5943; Residues in Corn, Sorghum, Peanuts, and Corn Dry Milled Processed Fractions; EPA Accession Nos. 262999, 263002, 263022, 264946; RCB Nos. 1367, 1368, 1369, 1444; and update of previous conclusions on these commodities and soybeans.

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December 24, 1986, SVH to VW, review of Monsanto protocols for legume processing studies, Accession No. 264946, RCB No. 1443.

May 23, 1986, Michele L. Loftus (MLL) to RT and M. McDavit, Analytical Methodology for Meat, Milk and Eggs, Monsanto Response, No. Accession No. RCB No. 449.

May 13, 1986, SVH and MLL to VW and Jane Talarico, Changes in conclusions regarding Registration Standard data requirements and dietary exposure estimates based on new information.

May 12, 1986, SVH to VW, Review of Accession No. 260257, RCB No. 448, Monsanto MSL-5165, MSL-3157, Storage Stability Data for Alachlor DEA and HEEA Metabolites in Soybeans (1 year), and Acetochlor MEA metabolites in corn, soybean, and peanut forage (3 years).

April 18, 1986, MLL to Robert Taylor (RT), RCB No. 478, Protocol for Field Residue Trials for legumes.

March 17, 1986, SVH to VW, review of Accession No. 260643, RCB No. 452, Monsanto Report MSL-5118, MSL-4534, Residues in corn grain (LOQ 2 ppb).

March 10, 1986, SVH and MLL to Mike McDavit and Gary Burin (GB), review of Accession Nos. 257523 and 257526, RCB No. 942, Monsanto Response to PDl.

February 14, 1986, SVH to VW, review of Accession Nos. 260259 and 260260, RCB No. 284, Monsanto MSL-5158, MSL-4942, MSL-5123, Residues in Soybean Processed Fractions.
January 15, 1986, Francis D. Griffith to Mike McDavit (MM) and RT, Alachlor MTO Report (DEA Metabolites only).

November 1, 1985, MLL to RT and TOX, Accession No. 257285, RCB No. 1009, Monsanto MSL-4613, MSL-3886, MSL-4230, Metabolism in Ruminants and Poultry.

October 31, 1985, SVH to VW, Accession No. 257274, RCB No. 1063, Monsanto MSL-4622, MSL-3234, Residues in Dry Beans, DEA Metabolites only.

October 31, 1985, SVH to VW, Accession No. 258142, RCB Nos. 1302 and 1303. Monsanto MSL-4774, MSL-4535, Residues in Soybeans, Preemergent Application.

October 31, 1985, SVH to VW, Accession No. 257274, RCB Nos. 1000 and 1001, Monsanto MSL-4625, MSL-3980, Residues in Peanuts, Preemergent Application.

October 31, 1985, SVH to VW, Accession No. 257284, RCB Nos. 1012 and 1013, Monsanto MSL-4621, MSL-2869, MSL-2873, Residues in Sunflowers, Preemergent Application, DEA metabolites only, Discussion of previously submitted data on corn, postemergent layby application, DEA metabolites only.

October 29, 1985, MLL to VW and GB, Accession No. 257271, RCB Nos. 1006 and 1007. Monsanto MSL-4636, MSL-3603, Residues in Corn grain, forage, stover, soybean grain, forage, hay, hulls, meal, oil.

We note that a response to deficiencies in previous reviews has been recently received by the Agency, but not reviewed. (Monsanto letter of May 29, 1987). An additional submission including a revised protocol for beans and peas and some validation data has also been received, but not reviewed. (Monsanto letter of April 30, 1987, 2 bound volumes, no MRID No. assigned).

REGISTERED USES

The registered uses for alachlor are discussed below. Aerial applications were removed from all labels in connection with the Alachlor Registration Standard. The Alachlor PD2/3 proposed allowing reinstatement of aerial applications based on applicator exposure data. Broadcast boom and banded applications are registered. Center pivot application is also registered.

Corn: The Section 3 labels for corn have a maximum application rate for alachlor on corn of 4-8 lb ai/A, depending on soil type. The application rate > 4 lb ai/A can be used on corn for coarse soils containing 10 percent or more organic matter (4 to 6 lb ai/A) and for peat and muck soils (6 to B lb ai/A). For all other soils, the maximum application rate is 4 lb ai/A. Preplant incorporated, preemergence, or early post emergence (before the corn is 5" high) applications may be made. The registered labels for corn also allow a second treatment for hard to control weeds (N.T.E. 8 lbs ai/A/season). Both treatments must be before the corn reaches 5 inches in height: i.e., early. The maximum Section 24(c) use for alachlor on corn (NE, IL, CO, OH) is a pre-plant or pre-emergence treatment at $\leq$ 4 lbs ai/A followed by a late post-emergence (when the corn is up to 40 inches high) layby treatment at 2-3 lbs ai/A (N.T.E. 6.5 lbs ai/A/-season). The 24(c) label contains an impractical feeding restriction. (Corn forage and fodder is not under grower control, except for sweet corn and pop corn fodder and

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forage.) Lasso EC is registered for use on corn. Lasso Micro-tech (micro-encapsulated formulation) is not registered for use on corn.

Soybeans: On section 3 labels, the maximum registered rate for alachlor on soybeans is 4 lb ai/A. For hard to control weeds, a second treatment at up to 4 lb ai/A is allowed not to exceed 8 lb ai/A/season. Applications may be made preplant, preemergence, and/or early post emergence, i.e., before the soybeans exceed the unifoliate stage (first two true leaves). Feeding of soybean forage and hay is prohibited when post emergence application is used. Monsanto's market share data show that the percent of acreage receiving the second treatment is negligible (private communication between M. Loftus (RCB) and Lyle Gingrich (Monsanto)). Monsanto indicated that for hard to control weeds (shattercane and woolly cupgrass), other pesticides are used. These Monsanto market share data are in agreement with those of BUD (Private communication with R. Petrie). Lasso EC and Lasso Micro-Tech are registered for use on soybeans. No soybean data were included in this submission.

Sorghum (milo): The maximum Section 3 use for alachlor on sorghum-(milo) is treatment at 4 lb ai/A, preplant incorporated or preemergent. The same rate may be used in tank mixes with Atrazine, Modown, or Propazine. The label does not prohibit sequential applications. Lasso EC is registered for use on sorghum (milo). Lasso Micro-Tech is not registered for use on sorghum (milo). A Lasso/Atrazine premix is registered for use on sorghum (milo) at lower rates than those given here. No residue data for sorghum were included in this submission.

Peanuts: The maximum Section 3 use for alachlor on peanuts is one treatment at 4 lbs ai/A to be applied pre-plant, preemergence or at cracking (emergence). When applied as a tank mix with Dynap, the maximum section 3 use for alachlor on peanuts ia two sequential treatments, each at $\leq$ 4 lbs ai/A, the first pre-plant and the second at cracking (emergence). Feeding of peanut forage and hay is not restricted on the Section 3 label, although a feeding restriction would be considered practical. The maximum Section 24(c) use for alachlor on peanuts is a pre-plant, pre-emergence or at cracking treatment followed by a late post-emergence layby treatment (immediately after the last cultivation), each at $\leq$ 4 lbs ai/A or a single application - preplant, preemergence, or at cracking - at 8 lb ai/A. Section 24(c) registrations have been obtained in both North Carolina and Virginia. Feeding of peanut forage and hay is restricted on the 24(c) label. Lasso EC is registered for use on peanuts. Lasso Micro-tech is not registered for use on peanuts.

Dry Beans: The maximum Section 3 use for alachlor on dry beans is one preplant treatment at 3 lb ai/A west of the Mississippi, except in CA (Lasso Microtech) or Kern Co., CA (Lasso EC). Do not apply on dry beans after planting as crop injury may occur. Alachlor may be used on red kidney beans in IL, WI, and IN (Lasso EC only) for a 3 lb ai/A treatment preplant or preemergence. The label does not prohibit both preplant and pre-emergence treatments from being used. Older labels (Section B of PP#2G1176) contained this restriction. Both Lasso EC and Lasso Microtech may be used on dry beans. Alachlor may be used on navy beans in MI at 2 lb ai/A preplant incorporated (24(c) use in MI).

Lima Beans: The maximum Section 3 use for alachlor on lima beans is preplant or preemergence application of 3 lb ai/A in all states except CA. Both Lasso EC and Lasso Microtech may be used on Lima Beans. A 24(c) registration was obtained in MD for preplant incorporated or preemergence application at 2 lb ai/A. Section 3 and 24(c) labels do not prohibit the use of both applications. Older labels (Section B of PP#2G1176) contained this restriction.

Peas (for processing, MN only): The maximum Section 3 use is one preemergence treatment at 2.5 lb ai/A. Both Lasso EC and Lasso Microtech may be used on peas for processing in MN. The National Pesticide Information Retrieval Service (NPIRS) lists a 24(c) for this use in WA, as well.

Sunflowers: The maximum Section 3 use is preplant incorporated or preemergence application of Lasso at 4 lb ai/A. Either banded or broadcast application may be used. Grazing and feeding of forage is prohibited. The label does not prohibit the use of both preplant incorporated and preemergent applications. Lasso Microtech is not registered for use on sunflowers.

Cotton: Lasso may be used in OK and certain TX counties. Preemergence broadcast or banded application at up to 2 lb ai/A may be used. The Lasso label does not have a feeding restriction for cotton forage. Lasso EC may be used in TX, OK, LA, NM, AZ, and CA. Preplant incorporated application at up to 4 lb ai/A or preemergent application at 3 lb ai/A may be made, except in LA. In LA, one preemergent application at 2 lb ai/A may be made. The label does not prohibit the use of both preplant and preemergence application. Older labels (Section B of PP#9F0776) contained this restriction. No feeding restriction is on the label. Lasso Micro-Tech is not registered for use on cotton.

NATURE OF THE RESIDUE - PLANTS

The metabolism of alachlor in corn and soybeans was recently reviewed (PP#0F2348, M. Kovacs, 4/23/84). The residue of concern includes alachlor, metabolites containing the 2,6-diethylaniline moiety (2,6-DEA), and metabolites containing the 2-(1-hydroxyethyl)-6-ethylaniline moiety (2,6-HEEA). TOX has indicated that, in the absence of data showing that the HEEA metabolites are safe, these metabolites should be included in the tolerance expression (A. Malfouz, personal communication, 9/16/85). This requires re-evaluation of the tolerance levels and the analytical methodology, since, prior to M. Kovac's review, only metabolites containing the DEA moiety were considered.

NATURE OF THE RESIDUE - ANIMALS

The metabolism of alachlor in ruminants and poultry is not adequately understood (M. L. Loftus, 11/1/85, Accession No. 257285, RCB No. 1009). Although 60 to 70% of the residue in goat and hen excreta was characterized and found to contain either the DEA or HEEA moiety, as found in plants, the residue in tissues, eggs and milk was not adequately characterized.

Except for liver, the residues in the tissues were not characterized, and the minimal characterization of the residues in the liver did not provide information on the type of aniline moiety. Twenty-four percent of the residue in eggs was characterized by acid pressure hydrolysis and found to contain residues containing the DEA and HEEA moiety. Twelve percent of the residue in eggs consisted of other products including those containing the 2,6-di-(1-hydroxy-ethyl)aniline moiety. Sixty-four percent of the residue in eggs was not characterized. A large portion of the 64% uncharacterized residue in eggs was due to experimental mishap (charring of the water soluble fraction during acid pressure hydrolysis/ acetylation). The goat milk was characterized by acid pressure hydrolysis and found to contain an equal mixture of metabolites containing either the DEA or the HEEA moiety. However, the percent activity attributable to these two types of metabolites in the goat milk was not reported.

No additional animal metabolism data were included in this submission. Thus the deficiencies outlined in our memo of 11/1/85 (M. Loftus, Accession No. 257285, RCB No. 1009) remain outstanding.

ANALYTICAL METHODOLOGY

Monsanto has submitted a number of different analytical methodologies for alachlor residues, most of which are similar to the alachlor DEA metabolite method which failed an MTO (F. D. Griffith, 1/15/86). These methods include a solvent extraction, an acid or base hydrolysis to produce diethyl aniline (DEA) or hydroxyethyl ethyl aniline (HEEA) from the DEA or HEEA containing metabolites, steam distillation of the DEA and HEEA using custom made glassware. Several different cleanups and detection systems are used. DEA has been cleaned up using an alumina/florisil column and quantitated by GC using a nitrogen phosphorus detector. HEEA has been cleaned up using an AG-50 cation exchange column followed by solvent cleanup, derivatization with TFAA, and quantitation by GC/ECD. The DEA portion of this method outline failed the MTO. This combination may be the "separate method" Monsanto referred to in their storage stability data submission. Alachlor residues have also been analyzed by HPLC with electrochemical detection.

Methods previously submitted for soybeans and peanuts (S. Hummel, 2/14/86, and 12/24/86) used a solvent cleanup following the steam distillation, followed by separation of DEA and HEEA by normal phase HPLC using an amine bonded phase column. DEA and HEEA were derivatized with HFBA and TFAA, respectively, and quantitated by GC/ECD.

Methods previously submitted for corn grain and legumes (S. Hummel, 3/17/86 and 12/24/86) used a solvent cleanup following the steam distillation, followed by addition of fluoro-DEA as an internal standard. The extract was then derivatized with heptafluorobutyric anhydride (HFBA), and quantitated by GC/NICI-MS using a DB-5 bonded phase capillary column and selected ion monitoring (SIM).

A method previously submitted for peanut commodities (S. Hummel, 1/30/87) did not require the use of the custom made glassware. The same extraction step was used. Base pressure hydrolysis was used to convert the residues to DEA and HEEA. The DEA and HEEA were then extracted with methylene chloride and the HEEA converted to methoxyethyl ethyl aniline (MEEA) with methanol. The DEA and MEEA were then analyzed by HPLC with electrochemical detection.

To date, Monsanto has not submitted data on the applicability of the PAM Multiresidue Methodology to detect alachlor and its metabolites. This requirement was published in the Federal Register on September 26, 1986 (51 FR 34249), and appears in 40 CFR 158.125. Copies of the FR Notice and the four FDA Multiresidue protocols were attached to our

previous review (S. Hummel, 1/30/87). These data are required.

Five different methods are included in these submissions. All of the five methods are similar to the method outlines above. Descriptions of these methods follow.

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Hydroxyethyl)-6-Ethylaniline (HEEA) Yielding Alachlor Metabolites in Legume Vegetable Commodities by Gas Chromatography/Mass Spectrometry (GC/MS)." Appendix-C of MSL-6218 and MSL-6224, [MRID Nos. 400399-01 and 400403-01].

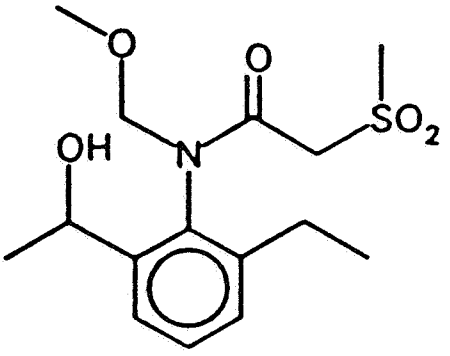
Samples are extracted with 20% water/acetonitrile. The solvent is evaporated to near dryness by rotary evaporation at 40C. The extract is hydrolyzed in base to produce DEA and HEEA. The reaction of metabolites producing DEA and HEEA is shown in Figure 1. The DEA and HEEA are steam distilled in custom made glassware, and collected in acid. The distillate is washed with hexane, made basic, and the DEA and HEEA partitioned into methylene chloride. The extract is solvent exchanged with iso-octane. Fluoro-DEA is added as an internal standard. The FDEA, 2,6-DEA and 2,6-HEEA are derivatized with heptafluorobutyric anhydride (HFBA). The derivatives are evaporated to dryness under a stream of nitrogen and reconstituted with isooctane, and washed with sodium bicarbonate to neutralize any residual acid from the derivatization. Quantitation is by GC/MS, using a Varian 8000 Auto-sampler, a Finnigan 9611 GC and a Finnigan 4500 series mass spectrometer with an INCOS Data System. Selected Ion Monitoring (SIM) was used. DEA was monitored at m/z 325. FDEA and HEEA were monitored at m/z 343. Data were collected for m/z 213, as well. 15 m DB-210 bonded phase capillary column is used for the separation.

2,6-Diethylaniline (available from Aldrich) and 2-(1-Hydroxyethyl)-6-ethylaniline (synthesized in-house) are used as standards. Two metabolites, sodium salt of 2-[(2,6-diethylphenyl) (methoxy-methyl)amino]-2-oxo-ethane sulfonic acid (tertiary amide sulfonic acid metabolite, containing 2,6-DEA moiety), and N-[2(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-2-(methylsulfonyl) acetamide (hydroxyethyl tertiary amide sulfone metabolite containing 2,6-HEEA moiety), are used for fortification and recovery calculations. The structure of these metabolites are shown in Figure 1.

Ratios of peak area of the analyte to the peak area of the internal standard were plotted. Residues were expressed as alachlor equivalents. The limit of quantitation (LOQ) (limit of method validation, i.e., the method was not validated below this level) is reported to be 0.010 ppm in all

FIGURE 1

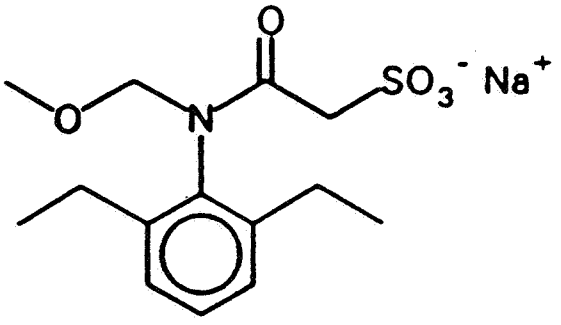
REPRESENTATIVE ALACHLOR METABOLITES



HEEA Yielding

"Hydroxyethyl Methylsulfone Metabolite"

N-[2-(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-
2-(methylsulfonyl)acetamide



DEA Yielding

"Sulfonic Acid Metabolite"

2-[(2,6-diethylphenyl)(methoxymethyl)amino]-
2-oxoethane sulfonic acid, sodium salt

commodities. Sample chromatograms for standards; and one check sample, one field treated sample (2 lb ai/A), and one sample fortified at the LOQ for lima bean forage and lima beans were included with the analytical methods. The sample numbers on the chromatograms included with the method correspond to sample numbers for samples analyzed for these submissions. Formulas for sample calculations were included. Recoveries were determined and reported as follows.

RECOVERIES (%)

Commodity	2,6-DEA range	2,6-DEA average	2,6-HEEA range	2,6-HEEA average
pea forage	78-93	85	76-116	88
lima bean forage	82-100	91	64-100	87
succulent pea seed	88-102	94	91-125	101
succulent lima bean seed	73-88	84	78-105	90

Recoveries were determined again when the samples were analyzed, and reported as follows. Recoveries of all similar types of samples were averaged together.

RECOVERIES (%)

Commodity	2,6-DEA range	2,6-DEA average	2,6-HEEA range	2,6-HEEA average
Bean & pea forage	55-112	85	60-140	80
Succulent seeds	84-98	89	71-108	86
Vines	68-101	86	69-94	80
Dry seeds	82-91	86	70-100	84
Straw	84-114	96	61-114	91

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Hydroxyethyl)-6-Ethylaniline (HEEA) Yielding Alachlor Metabolites in Peanut Nutmeat, Peanut Meal, Crude Peanut Oil, Refined Peanut Oil, Deodorized Peanut Oil, Peanut Protein Concentrate, and Peanut Protein Isolate," Appendix C of MSL-6100 (MRID No. 400404-01).

Samples are extracted with 20% water/acetonitrile. The solvent is evaporated to near dryness. The extract is hydrolyzed in base to produce DEA and HEEA. (Oil and soapstock are hydrolyzed directly with base, omitting the extraction and evaporation steps. The DEA and HEEA are steam distilled in custom made glassware,and collected in acid. The distillate is washed with hexane, made basic, and the DEA and HEEA partitioned into methylene chloride. The extract is solvent

exchanged with iso-octane, and the DEA and HEEA are separated and cleaned up by normal phase HPLC using an amine bonded-phase column with automatic fraction collection. The isolated 2,6-DEA and 2,6-HEEA are derivatized with heptafluorobutyric anhydride (HFBA) and trifluoroacetic anhydride (TFAA), respectively. Quantitation is by GC/ECD. A 60 m SPB-35 wide bore (0.75 mm id) capillary column is used for the separation. The temperature of the column was programmed from 110 to 270 C. Nitrogen was used as the carrier gas. Calculations were described. Results are expressed as alachlor equivalents.

2,6-Diethylaniline (available from Aldrich) and 2-(1-Hydroxyethyl)-6-ethylaniline (synthesized in-house) are used as standards. Two metabolites, sodium salt of 2-[(2,6-diethylphenyl) (methoxy-methyl)amino]-2-oxo-ethane sulfonic acid (tertiary amide sulfonic acid metabolite, containing 2,6-DEA moiety), and N-[2(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-2-(methylsulfonyl) acetamide (hydroxyethyl tertiary amide sulfone metabolite containing 2,6-HEEA moiety), are used for fortification and recovery calculations. The structures of these metabolites are shown in Figure 1.

The limit of quantitation (LOQ) (limit of method validation, i.e., the method was not validated below this level) is reported to be 0.010 ppm in all commodities. Undated sample chromatograms for standards; and one check sample, one field treated sample (6-8 lb ai/A), and one sample fortified at a level greater than the LOQ for each commodity were included with the analytical methods. No chromatograms were included with the samples analyzed for these submissions. These chromatograms are required. Chromatograms are needed for samples fortified at the LOQ. Formulas for sample calculations were included. Recoveries were determined and reported as follows.

RECOVERIES (%)

Commodity	2,6-DEA range	2,6-DEA average	2,6-HEEA range	2,6-HEEA average
peanuts	70-100	86	64-85	75
peanut meal	62-900	73	60-86	73
crude oil	79-92	81	56-88	76
refined oil	73-98	83	50-73	63
bleached oil	72-89	80	56-91	78
deodorized oil	58-92	77	65-79	68
soapstock	77-95	85	61-100	71
protein conc.	69-91	80	66-102	82
protein isolate	66-90	76	56-110	76

"Analytical Method for the Determination of Alachlor Metabolites in Sunflower Seed, Crude Oil, and Meal with Hulls," R. Lauer and L. M. Horner, Appendix D of MSL-6201 (MRID No. 400401-01.)

This analytical method is similar to the previously submitted HPLC/OCED method for peanut commodities, which does not require the use of custom made glassware. However, it does require the use of the custom made glassware used in the other earlier methods. For this reason, the method would be unacceptable for enforcement purposes. Methoxyethylethylaniline (MEEA) is produced from HEEA. The DEA and MEEA are determined by HPLC with oxidative coulometric electrochemical detection (OCED). No derivatization is required.

Samples are extracted with 20% water/acetonitrile. The solvent is evaporated to near dryness, and reconstituted with water with a non-ionic surfactant added. The extract is hydrolyzed in base, and the DEA and HEEA steam distilled into dilute acid using custom made glassware. The distillate is made basic. The DEA and HEEA are then extracted with methylene chloride, and partitioned into methanolic HCl. After separation, additional methanol is added, and the solution is allowed to sit overnight (for approximately 12 hours) at room temperature to convert HEEA to MEEA (methoxyethylethylaniline). The pH of the aqueous/methanolic solution is then adjusted to 6.0. The volume of the methanol/water layer is adjusted with 50% methanol/water. The DEA and MEEA are then separated by reverse phase HPLC using a Zorbax C-8 column (4.6 mm x 15 cm) and 45:55 pH 4.8 acetate buffer/-methanol (v/v). The electrochemical detector is an Oxidative Coulometric Electrochemical Detector - ESA Model 5100A Coulochem Detector with Model 5010 analytical cell and Model 5020 guard cell.

2,6-Diethylaniline (available from Aldrich) and 2-(1-hydroxyethyl)-6-ethylaniline (synthesized in-house) are used as standards. The same two metabolites listed above for the other methods, sodium salt of 2-[(2,6-diethylphenyl) (methoxymethyl)amino]-2-oxo-ethane sulfonic acid (tertiary amide sulfonic acid metabolite, containing 2,6-DEA moiety), and N-[2(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-2-(methylsulfonyl)acetamide (hydroxyethyl tertiary amide sulfone metabolite, containing 2,6-HEEA moiety), are used for fortification and recovery calculations.

External Standards were used for calibration. Some undated chromatograms were included with the method. However, only one of the chromatograms (meal from Jamestown, ND) was for a sample fortified at the claimed limit of quantitation (LOQ). Calculations were described. Results are expressed as alachlor equivalents. The limit of quantitation is

reported to be 0.010 ppm. Recoveries were determined and reported as follows.

	RECOVERIES (%)			
	2,6-DEA		2,6-MEEA	
Commodities	range	average	range	average
sunflower seed	74-90	83	72-93	82
Meal with hulls	79-94	87	69-83	77
Crude Oil	80-103	92	64-84	75

Some recoveries were determined again when the samples were analyzed, and were reported as follows.

	RECOVERIES (%)			
	2,6-DEA		2,6-MEEA	
Commodities	range	average	range	average
sunflower seed	86-108	92	75-95	83
crude oil *		91		75

*Only one level of fortification was used in these recovery experiments.

RCB conclusions on these methods

The methods discussed above for bean and pea commodities, peanut processed products, and sunflower seed commodities are not suitable for enforcement. These methods all require the use of custom made glassware, which is not commercially available. We will, however, accept residue data generated using these methods for the Special Review, and for generation of residue data for the Registration Standard, provided that the data are adequately validated (raw data including chromatograms, adequate storage stability data, etc.). However, the methods are not suitable for enforcement.

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) Yielding Metabolites and 2-(1-Hydroxyethyl)-6-Ethyl-aniline (HEEA)-Yielding Alachlor Metabolites in Cotton Seed," Appendix D of MSL-6185 (MRID No. 400404-01).

This analytical method is essentially the same as the previously submitted HPLC/OCED method for the analysis of peanut commodities (S. Hummel, 1/30/87). It is somewhat different from the method submitted for sunflower seed commodities discussed above. It does not require the use of

the custom made glassware used in the other earlier methods. Methoxyethylethylaniline (MEEA) is produced from HEEA. The DEA and MEEA are then determined by HPLC with oxidative coulometric electrochemical detection (OCED). No derivatization is required.

Samples are extracted with 20% water/acetonitrile. The extract is vacuum filtered, washed, and the solvent evaporated to near dryness in a Wheaton flask, using rotary evaporation at 50C. The extract is hydrolyzed in base under pressure at 155C to produce DEA and HEEA. The sample is cooled at room temperature for 1 hour. The DEA and HEEA are extracted with methylene chloride, and then partitioned into methanolic HCl. After separation, additional methanol is added, and the solution is allowed to sit overnight (for approximately 12 hours) to convert HEEA to MEEA (methoxyethylethylaniline). The pH of the aqueous/methanolic solution is then adjusted to 5-7. The volume of the methanol/water layer is adjusted with 50% methanol/water. The DEA and MEEA are then separated by reverse phase HPLC using a Zorbax C-8 column (4.6 mm x 15 cm) and 42:55 (45:55?) pH 4.8 acetate buffer/-methanol (v/v). The detector is an Oxidative Coulometric Electrochemical Detector - ESA Model 5100A Coulochem Detector with Model 5010 analytical cell and Model 5020 guard cell.

2,6-Diethylaniline (available from Aldrich) and 2-(1-hydroxyethyl)-6-ethylaniline (synthesized in-house) are used as standards. The same two metabolites listed above for the other methods, sodium salt of 2-[(2,6-diethylphenyl) (methoxymethyl)amino]-2-oxo-ethane sulfonic acid (tertiary amide sulfonic acid metabolite, containing 2,6-DEA moiety), and N-[2(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-2-(methylsulfonyl)acetamide (hydroxyethyl tertiary amide sulfone metabolite, containing 2,6-HEEA moiety), are used for fortification and recovery calculations. Four additional metabolites are used as standards, as well. These standards are:

2-[N-Methoxymethyl-[2-(1-hydroxyethyl-6-ethylphenyl]amino]oxo Acetic acid, sodium salt (contains 2,6-HEEA moiety)

2-([6-ethyl-2-(1-hydroxyethyl)phenyl]-N-(methoxymethyl)amino)-2-oxo ethane sulfonic acid, sodium salt (contains 2,6-HEEA moiety)

N-(2,6-diethylphenyl)-2-hydroxy-N-(methoxymethyl)acetamide (contains 2,6-DEA moiety)

[(2,6-diethylphenyl)-methoxymethyl)amino]-oxo acetic acid (contains 2,6-DEA moiety)

The six metabolites are synthesized in-house by Monsanto.

External Standards were used for calibration. Some undated chromatograms of cottonseed samples were included with the method. However, no chromatograms were submitted for samples of cottonseed meal or cottonseed oil samples. Calculations were described. Results are expressed as alachlor equivalents. The limit of quantitation is reported to be 0.010 ppm. Recoveries were determined and reported as follows.

	RECOVERIES (%)			
	2,6-DEA		2,6-MEEA	
Commodities	range	average	range	average
cottonseed	62-100	76	79-115	94

RCB Conclusions on Analytical method for Cottonseed

This method does not require the use of custom made glassware. Additionally, the range of recoveries is not as large and the average recovery is higher than those for the analytical methods for corn and sorghum commodities discussed in our previous review (S. Hummel, 1/30/87).

A similar method (for peanut commodities) is being recommended for an MTO. A final conclusion on the acceptability of these methods for enforcement purposes will be made after the MTO has been completed.

RESIDUE DATA

The Alachlor PD2/3 proposed reinstatement of aerial application due to applicator exposure considerations. No residue data have been submitted to support aerial application on any crop. These data will be needed if aerial application is to be reinstated on product labels.

Storage Stability Data

Monsanto submitted storage stability data for alachlor DEA and HEEA metabolites on soybean grain stored for one year and storage stability data for acetochlor MEA metabolites on corn, soybean, and peanut forage stored for three years. No storage stability data for alachlor had been submitted previously. (S. Hummel, 5/12/86, Accession No. 260257, RCB No. 44B). No significant degradation of residues was reported. However, additional information on the soybean grain analytical methods was needed and has not been submitted to date.

In the above cited review, we reserved judgment on the storage stability data for alachlor residues on soybean grain until the analytical methods used were submitted and reviewed. If considered sufficient, these data will support only those residue data on oil crops for which the samples have been stored less than one year. Since corn grain samples from recently submitted residue field trials were stored for several years (S. Hummel, 3/17/86, Accession No. 260643, RCB No. 452), this storage stability study is not adequate. Thus, a storage stability study reflecting several years of storage of an oil crop is needed.

Translating from acetochlor MEA metabolite residue data, we concluded that residues of alachlor and its DEA metabolites are stable for up to three years in forage crops. We could make no such conclusion for HEEA metabolites of alachlor, because the hydroxylated metabolites of acetochlor were not determined.

To satisfy the storage stability data requirement, we concluded that the registrant must provide storage stability data for the DEA and HEEA metabolites of alachlor on soybean or corn grain stored for $\geq$ 2 years including data points at interim times. Storage stability data were also required for the DEA and HEEA metabolites of alachlor in animal tissues. Storage stability data for residues of the hydroxylated metabolites of alachlor or acetochlor in forage crops were required, as well. The registrant was reminded that the length and conditions of sample storage in the storage stability tests should reflect those in the residue field studies. (S. Hummel, 3/17/86, Accession No. 260643, RCB No. 452).

Storage stability data are typically required on a minimum of three diverse crops. For alachlor, we have required storage stability data on forage from a forage crop, and on a legume, which will be translated to grain and oilseed crops. Some storage conditions were submitted for cottonseed samples. These samples were stored unfrozen. No storage stability data are available for unfrozen storage.

BEANS AND PEAS, DRY AND SUCCULENT

The maximum Section 3 use for alachlor on dry beans is one preplant treatment at 3 lb ai/A west of the Mississippi, except in CA (Lasso Microtech) or Kern Co., CA (Lasso EC). Alachlor may be used on red kidney beans in IL, WI, and IN (Lasso EC only) for a 3 lb ai/A treatment preplant or preemergence. Both Lasso EC and Lasso Microtech may be used on dry beans. Alachlor may be used on navy beans in MI at 2 lb ai/A preplant incorporated (24(c) use). Alachlor is not registered for use on snap beans.

Alternatively, the second treatment on peanuts and the late postemergence layby treatment may be removed from the labels.

According to 40 CFR 162.154 (b)(1)(ii), the Administrator may disapprove a State Registration at any time if the Administrator determines that the use may result in a residue on food or feed exceeding or not covered by a tolerance, exemption, or other clearance under FFDCA. Accordingly, we recommend that the 24(c) registration for the use of alachlor on peanuts at layby be disapproved at this time.

In addition, there are deficiencies in peanut residue data already submitted in response to the Standard. These deficiencies are summarized in Conclusions 5k-5m, 5o, and 5q of our memo of 1/30/87 (S. Hummel), and involve data reviewed in that memo (Accession No. 263022, RCB No. 1369) and data reviewed in our memo of 10/31/85 (S. Hummel, Accession No. 257274, RCB Nos. 1000, 1001).

Peanut Processing Data

Peanuts were ground and fractionated into oil and defatted meal by Soxhlet extraction using hexane as a solvent. The defatted meal was air dried to remove residual hexane. Crude oil was produced by evaporation of the hexane by rotary evaporation. The crude oil was alkali refined by adding 10% NaOH. The mixture was shaken, heated at 60-70C for 30 minutes and shaken for another 10 minutes. After phase separation, the lower aqueous layer was discarded. The soapstock/oil emulsion was centrifuged at 11,000 rpm for 20 minutes. The alkali refined oil and the soapstock were analyzed. The alkali refined oil was then bleached by adding 1% Fullers earth and heating under vacuum using a rotary evaporator with boiling water. The oil was centrifuged and decanted. Bleached oil was deodorized by steam distillation at 250C and 5-10 mm Hg. This processing procedure is similar to the processing procedure Monsanto used for soybean and corn, and similar to commercial practice.

Peanut protein (protein concentrates and isolates) can be used as a protein source, e.g., in flour and infant formula, much like soy protein. This is being done in other countries such as India, but not to a great extent in the United States (J. Woodroof, "Peanuts, Production, Processing, Products," Avi Publishing Company, Westport, CT, 1973). Peanut protein concentrates were prepared from peanut meal by precipitating with 50% aqueous ethanol. The precipitated protein concentrates were then air dried overnight on a plastic sheet at ambient temperature. Peanut protein isolates were prepared from peanut meal by extraction with NaOH solution at pH 9. The pH is adjusted to 4.5 with phosphoric acid to precipitate the protein isolates. The protein isolates were then air

dried overnight at ambient temperature on a plastic sheet. This process is the same as Monsanto used for processing of soy protein concentrates and isolates, and is similar to commercial practice.

Peanut samples from previous residue field trials were processed. As discussed above in the analytical methodology section, the claimed limit of quantitation (LOQ) was 0.010 ppm in each commodity. However, no chromatograms were submitted for samples fortified at the claimed LOQ, except for peanut soapstock. Other chromatograms submitted with the analytical method were from samples fortified at 0.020 ppm. None of the chromatograms were dated. It is not clear if the chromatograms were from samples included in the report.

Residues reported as the average of duplicate analyses were used in the calculation of Concentration/Reduction factors. A concentration/ reduction factor is a number which may be multiplied by the residue in peanuts to obtain the residue in the processed fraction. A factor greater than one (1) indicates concentration; and a factor less than one (1) indicates reduction in residue. The concentration/reduction factors determined for peanut processed fractions are presented in Table 8. Alachlor residues can concentrate slightly in alkali refined peanut oil. Residues concentrate in peanut meal, but are reduced to less than the residue in peanuts when the meal is further processed into protein concentrates and protein isolates for human consumption. Both food and feed additive tolerances will be needed for peanut meal, since peanut meal is both a human food and an animal feed.

TABLE 8

CONCENTRATION/REDUCTION FACTORS FOR PEANUT PROCESSED FRACTIONS

Fraction	Range	Average	Average %DEA
Peanuts			5
Meal	1.01-1.8	1.37	6
Soapstock	0.13-0.48	0.20	<12
Crude Oil	0.14-0.85	0.38	<10
Alkali Refined Oil	0.09-1.05	0.34	<11
Bleached Oil[1/]	<0.02-0.50	0.27	<13
Deodorized Oil[2/]	<0.02-0.15	0.06	13
Protein Concentrate	0.17-0.21	0.19	12
Protein Isolates	0.11-0.21	0.13	33

1/ Alkali Refined and Bleached Oil
2/ Alkali Refined, Bleached, and Deodorized Oil

Revised estimates of residues in peanut processed products are presented in Table 9 for a single treatment at 4 lb ai/A and in Table 10 for a single treatment at 8 lb ai/A.

TABLE 9

RESIDUE ESTIMATES IN PEANUT RACS AND PROCESSED PRODUCTS FROM SINGLE TREATMENT AT 4 LB AI/A

Product	Special Review Estimate (ppm)1/	Maximum Residue (ppm)1/
peanuts	0.27	0.27
meal	0.37	0.49
soapstock	0.05	0.13
crude oil	0.10	0.23
refined oil	0.02	0.04
protein concentrate	0.05	0.06
protein isolate	0.04	0.06
forage	3.4	3.4
hay	3.4	3.4
hulls	0.9	0.9

1/ Assumes single treatment at 4 lb ai/A

TABLE 10

RESIDUE ESTIMATES IN PEANUT RACS AND PROCESSED PRODUCTS FROM SINGLE TREATMENT AT 8 LB AI/A

Product	Special Review Estimate (ppm)1/	Maximum Residue (ppm)1/
peanuts	0.87	0.87
meal	1.19	1.57
soapstock	0.33	0.42
crude oil	0.30	0.74
refined oil	0.05	0.13
protein concentrate	0.15	0.16
protein isolate	0.11	0.16
forage 2/	12.0	12.0
hay 2/	4.9	4.9
hulls	2.7	2.7

1/ Assumes single treatment at 8 lb ai/A
2/ Feeding of forage and hay is restricted on the 24(c) labels which permit use of the 8 lb ai/A rate.

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Special Review estimates are obtained by multiplying the maximum residue found on the rac when treated at the maximum application rate by the average concentration/reduction factor. Residue estimates for the purpose of tolerance setting are obtained by multiplying the maximum residue found on the rac when treated at the maximum application rate by the maximum concentration/reduction factor. These estimates are tentative, due to the lack of validation data as discussed above. Figures for peanut protein concentrates and protein isolates are tabulated here, although it is not clear if these peanut processed fractions are used in the United States to any great extent.

SUNFLOWER SEEDS,

The maximum Section 3 use is one preplant incorporated or preemergent surface application of Lasso at up to 4 lb ai/A. Either banded or broadcast application may be used. Grazing and feeding of forage is prohibited. The label does not prohibit the use of both preplant incorporated and preemergent applications. Lasso Microtech is not registered for use on sunflowers.

No residue data had been previously submitted for sunflower commodities where both DEA and HEEA metabolites had been measured.

Current Submission

Preemergence applications of Lasso EC and Lasso II (an EC) were made in a total of four locations at 3 or 4 lb ai/A. Applications were made in the states of MN, ND, SD, and TX, which comprise 8%, 73%, 18%, and 1%, respectively, of the total annual US sunflower acreage. The report did not include samples from TX. No explanation was made for this omission. No data on sunflower forage were submitted. However, the label prohibits feeding of treated forage.

Sunflower seeds from Jamestown, ND contained the highest residues. These seed samples were fractionated into sunflower meal with hulls, and into crude oil. Monsanto indicates that a more detailed fractionation will be submitted in a future report. We await the submission of the report on these fractionation studies.

Most of the sample history for these samples is missing from the report. There is no indication of the type of treatment made, the method of application, (ground or aerial, broadcast or banded, etc.), dates of harvest, dates and conditions of storage of samples, etc. This information is needed for review.

Results reported were the average of triplicate determinations. Results were corrected for recovery. Maximum residues found are reported in Table 11. Residues in sunflower seed were comprised of an average of 14 % DEA metabolites. Residues after processing and concentration /reduction factors are reported below in Table 12. Revised Registration Standard and Special Review estimates are found in Table 13. Approximately 12% of the residue in sunflower meal with hulls consisted of DEA metabolites. Less than 8% of the residue in crude oil consisted of DEA metabolites. No residue data were submitted for sunflower forage. However, feeding of sunflower forage is restricted.

TABLE 11

MAXIMUM RESIDUES IN SUNFLOWER SEEDS FROM PREEMERGENT APPLICATION

Rate	Residue (ppm Alachlor equivalents) DEA	HEEA	Total
3 lb ai/A	0.0431	0.379	0.422
4 lb ai/A	0.0690	0.761	0.830

TABLE 12

CONCENTRATION/REDUCTION FACTORS FOR SUNFLOWER SEED FRACTIONS

Fraction	Total Residue 3 lb ai/A	4 lb ai/A	Conc./Reduction Factor
sunflower seed	0.422	0.830	-
meal with hulls	0.485	1.16	1.15-1.40
crude oil	<0.117	<0.110	0.13-0.28

TABLE 13

RESIDUE ESTIMATES IN SUNFLOWER SEED RACS AND PROCESSED PRODUCTS FROM SINGLE TREATMENT AT 4 LB AI/A

Product	Special Review Estimate (ppm)1/	Maximum Residue (ppm)1/
sunflower seeds	0.83	0.83
meal w/hulls	1.06	1.16
crude oil	0.17	0.23

The chromatograms submitted with the analytical method appear to correspond to samples analyzed for this report. However, the chromatograms are not dated. Additionally, only chromatograms of sunflower seed meal with hulls are fortified at the limit of quantitation. Additional chromatograms are needed of sunflower seeds and sunflower seed oil fortified at the limit of quantitation.

The complete sample history for each sample is needed from the time of application and planting until analysis.

Processing data are still needed for sunflower seed meal and hulls (separately). Based on data from other crops, residues of alachlor are expected to concentrate in sunflower seed hulls, and possibly in sunflower seed meal. The registrant may want to submit data for refined sunflower oil since residues are likely to decrease with refining.

COTTONSEED

Lasso may be used in OK and certain TX counties. One preemergent broadcast or banded application at up to 2 lb ai/A may be used. The Lasso label does not have a feeding restriction for cotton forage. Lasso EC may be used in TX, OK, LA, NM, AZ, and CA. One single preplant incorporated at up to 4 lb ai/A or preemergent application at 3 lb ai/A may be made, except in LA. In LA, one preemergent application at 2 lb ai/A may be made. The label does not prohibit the use of both preplant and preemergence application. No feeding restriction is on the label. Lasso Micro-Tech is not registered for use on cotton.

This is the first submission of residue data for cottonseed which includes analysis for both DEA and HEEA metabolites of alachlor. The abstract of the report identifies it as an interim report. We await the submission of the final report for this study.

Preemergence application of alachlor was made at 2 and 3 lb ai/A in LA, MS, TN, and TX. Preplant incorporated application at 3 and 4 lb ai/A was made in CA, AZ, and TX. PHI's ranged from 122 to 166 days. Results from four of the seven locations were included in this report, which was called an interim report. Results were not reported from CA and AZ. In the other locations for which results were reported, no detectable residues (<0.010 ppm of each of DEA and HEEA metabolites of alachlor) were found in any undelinted cotton-seed sample. No analyses of cotton forage samples were reported. These data are needed. Alternatively, a feeding restriction may be placed on labels. The PM should take

appropriate action regarding the non-submittal of the cotton forage data.

Cottonseed processing studies were not submitted. These data were required by the Alachlor Registration Standard. Without valid exaggerated rate residue data, we cannot conclude that a cottonseed processing study is not needed.

Sample history sheets were included from the field cooperators. Samples from LA were treated by ground broadcast boom sprayer. Samples were stored for five days in the Monsanto office in Baton Rouge, LA (conditions not given, but presumably at room temperature), ginned, then frozen in dry ice and shipped to St. Louis. Storage conditions in the laboratory and dates of analysis were not given. Samples from TN were treated by ground boom broadcast application on the day of planting. Samples were not frozen, held for two days, then shipped to St. Louis. Storage conditions in the laboratory and dates of analysis were not given. From the date of the report, it appears that samples may have been stored in the laboratory for three months prior to analysis. Samples from Lubbock, TX, were treated by stationary ground boom broadcast. Samples were held one day (storage conditions not given), ginned, and frozen 1 hour after ginning. Additional sample was collected at a later date. Samples from Hidalgo, TX were treated on the day of planting by ground broadcast. Samples were stored at 85-95F for 8 days, and then shipped unfrozen to St. Louis. Since none of the samples were apparently frozen until well after harvest, and storage stability data are not available for the conditions under which these samples were stored, we question the validity of this study. Additional data with adequate geographical representation will be needed for cottonseed.

CORN

No residue data on corn were included in this submission. Residue data where DEA and HEEA metabolites were measured have not been submitted to support maximum Section 3 uses. These data were required by the Registration Standard and have not been submitted. The PM should take appropriate action regarding the non-submittal of these data.

No residue data have been submitted for the post emergence directed layby application to corn (24(c) use), where both DEA and HEEA metabolites of alachlor were measured. Previously submitted residue data showed over-tolerance residues of alachlor DEA metabolites in corn forage and fodder (1.92 ppm in one location (which may be considered anomalous) and up to 0.28 ppm in other locations, after correction for recovery). Very few locations were included in the studies.

Residues in corn grain in these studies were non detectable (<0.05 ppm DEA metabolites). The label contains an impractical feeding restriction, "[d]o not graze or feed treated forage to livestock following application." Feeding restrictions on corn forage and fodder are impractical because these commodities are not under grower control (except for pop corn and sweet corn). When 24(c) applications for this use were first received, the label contained a 12 week PHI for feeding of corn forage and fodder.

According to 40 CFR 162.154 (b)(1)(ii), the Administrator may disapprove a State Registration at any time if the Administrator determines that the use may result in a residue on food or feed exceeding or not covered by a tolerance, exemption, or other clearance under FFDCA. Accordingly, we recommend that the 24(c) registration for the use of alachlor on corn at layby be disapproved at this time.

Additionally, deficiencies in previously submitted residue data have not been resolved. See our review of 1/30/87 (S. Hummel, Accession No. 262999, RCB No. 1367) for more information.

SOYBEANS

No residue data on soybeans were included in this submission. Residue data where both DEA and HEEA metabolites were measured have not been submitted to support maximum Section 3 uses. These data were required by the Registration Standard. The PM should take appropriate action regarding the non-submittal of these data.

Additionally, deficiencies in previously submitted residue data have not been resolved. These deficiencies were updated in our memo of 1/30/87 (S. Hummel). the most recent soybean residue data submission was discussed in our memo of 2/14/86 (S. Hummel, Accession No. 260259, 260260, RCB No. 284).

SORGHUM

No residue data on sorghum were included in this submission. A processing study for sorghum has not been submitted. Processed products of sorghum are flour and starch. Although these data were required by the Registration Standard, the required data may be translated from corn dry milled processed fractions when data on corn dry milled processed products are received.

Deficiencies in previously submitted residue data have not been resolved. See our review of 1/30/87 (S. Hummel, Accession No. 263002, RCB No. 1368) for more information.

SUMMARY OF RESIDUE ESTIMATES

Tentative estimates of maximum residues for the purpose of tolerance setting and best available estimates for the Special Review dietary exposure are tabulated below in Table 14. These estimates are based on reasonable assumptions as outlined in the Alachlor PD2/3. Additional residue data and validation data for previously submitted studies should be submitted soon. Without additional data, RCB cannot recommend basing a regulatory decision on these available estimates.

Special Review residue estimates, adjusted for percent of crop treated are tabulated below in Table 15. Estimates are tentative due to lack of validation data, and due to uncertainty about the maximum use pattern to be supported. Validation data would include complete sample history (dates of fortification and analysis, length and conditions of sample storage) and sample chromatograms obtained when the samples were analyzed (not when the analytical method was validated). We are requesting Monsanto and BUD to update the percent crop treated figures used in our dietary exposure analysis.

Tentative Registration Standard residue estimates are for a single preemergence application at 8 lb ai/A for corn and $\leq$ 4 lb ai/A for other crops. Tentative Registration Standard residue estimates for processed products are obtained by multiplying the tentative maximum residue estimate for the rac by the maximum concentration/reduction factor. Tentative Registration Standard residue estimates for peanut commodities after a single application at 8 lb ai/A are listed in footnote 2 of the table. Tentative Special Review residue estimates are based on the typical application rate of 4 lb ai/A for these commodities. Tentative Special Review residue estimates for processed commodities are obtained by multiplying the tentative maximum Special Review residue estimate for the rac by the average concentration/reduction factor.

Data from the use of the microencapsulated formulation (Lasso Microtech) were not used when Lasso Microtech was not registered for use on that crop. Deficiencies outlined above in sections for each crop and in our recent review (1/30/87, S. Hummel) must be corrected. These estimates will be updated as more residue data and validation data become available.

Table 14

TENTATIVE RESIDUE ESTIMATES (PPM ALACHLOR EQUIVALENTS) BASED ON MAXIMUM RESIDUES FOUND IN FIELD TRIALS ASSUMING 100 % CROP TREATED

Crop	Registration Standard Estimate	Special Review Estimate
Corn		
grain	0.019	0.016
K+CWHR	0.005	0.005
forage	0.60	0.60
fodder&stover	0.20	0.20
meal	0.021	0.015
(soapstock)1/	0.048	0.029
crude oil	0.076	0.042
refined oil	0.003	0.0019
Peanuts2/		
nuts	0.27	0.27
hulls	0.9	0.9
meal	0.49	0.37
soapstock	0.13	0.05
crude oil	0.23	0.10
refined oil	0.04	0.02
forage	3.4	3.4
vines	3.4	3.4
Soybeans		
grain	0.21	0.21
hulls	0.32	0.32
meal	0.36	0.26
crude oil	0.19	-
refined oil3/	0.05	0.04
protein concentrates	0.08	0.07
protein isolates	0.05	0.04
soapstock	0.52	0.38
forage	2.6	2.6
hay	2.0	2.0
Sorghum		
grain	0.035	0.035
forage	1.4	1.4
fodder&stover	0.65	0.65
Legumes		
bean/pea forage4/	2.6	2.6
bean/pea hay4/	4.6	4.6
pea seeds	0.03	0.03
lima bean seeds	0.03	0.03
dry bean seeds	0.035	0.035
dry pea seeds	0.12	0.12
succ. bean w/pod4/	0.21	0.21
peas w/ pods4/	0.27	0.27
lima beans w/pods4/	0.21	0.21

Table 14, continued

TENTATIVE RESIDUE ESTIMATES (PPM ALACHLOR EQUIVALENTS)
BASED ON MAXIMUM RESIDUES FOUND IN FIELD TRIALS
ASSUMING 100 % CROP TREATED

Crop	Registration Standard Estimate	Special Review Estimate
Sunflowers		
sunflower seeds	0.83	0.83
meal w/hulls	1.16	1.06
crude oil	0.23	0.17
Cotton		
cottonseed	<0.02	<0.02

1/ not regulated
2/ If 8 lb ai/A single application for use on peanuts is to remain registered under Section 24(c), then maximum residues are tentatively estimated at 0.87 ppm in peanuts, 2.7 ppm in peanut hulls, 4.8 ppm in peanut hay, and 12 ppm in peanut vines
3/ refined, deodorized oil for human consumption
4/ estimated from earlier residue data where only DEA metabolites of alachlor were measured

Table 15

TENTATIVE SPECIAL REVIEW RESIDUE ESTIMATES
ADJUSTED FOR PERCENT OF CROP TREATED

Crop	Special Review Estimate (ppm)	% Crop Treated	Adjusted Estimate (ppm)
Corn			
grain	0.016	35	0.0056
K+CWHR	0.005	35	0.0018
forage	0.60	35	0.21
fodder&stover	0.20	35	0.07
meal	0.015	35	0.0052
(soapstock)1/	0.029	35	0.010
crude oil	0.042	35	0.015
refined oil	0.0019	35	0.0007

Table 15, continued

TENTATIVE SPECIAL REVIEW RESIDUE ESTIMATES
ADJUSTED FOR PERCENT OF CROP TREATED

Crop	Special Review Estimate (ppm)	% Crop Treated	Adjusted Estimate (ppm)
Peanuts2/			
nuts	0.27	62	0.17
hulls	0.9	62	0.56
meal	0.37	62	0.23
soapstock	0.05	62	0.031
crude oil	0.10	62	0.062
refined oil	0.02	62	0.012
forage	3.4	62	2.1
vines	3.4	62	2.1
Soybeans			
grain	0.21	21	0.044
hulls	0.32	21	0.067
meal	0.26	21	0.055
refined oil3/	0.04	21	0.008
protein concentrates	0.07	21	0.015
protein isolates	0.04	21	0.008
soapstock	0.38	21	0.080
forage	2.6	21	0.55
hay	2.0	21	0.42
Sorghum			
grain	0.035	8	0.0028
forage	1.4	8	0.11
fodder&stover	0.65	8	0.052
Legumes			
bean/pea forage4/	2.6	2-15	0.39
bean/pea hay4/	4.6	2-15	0.97
pea seeds	0.03	3	0.0009
lima bean seeds	0.03	14	0.0042
dry bean seeds	0.21	15	0.032
dry pea seeds	0.12	3	0.0036
peas w/ pods4/	0.27	3	0.008
lima beans w/pods4/	0.21	14	0.029
Sunflowers			
sunflower seeds	0.83	2	0.016
meal w/hulls	1.06	2	0.021
crude oil	0.17	2	0.0034
Cotton			
cottonseed	<0.02	<1	<0.0002

1/ not regulated
2/ If 8 lb ai/A single application for use on peanuts is to remain registered under Section 24(c), then maximum

residues are tentatively estimated at 0.87 ppm in peanuts, 2.7 ppm in peanut hulls, 4.8 ppm in peanut hay, and 12 ppm in peanut vines
3/ refined, deodorized oil for human consumption
4/ estimated from earlier residue data where only DEA metabolites of alachlor were measured

MEAT, MILK, POULTRY, AND EGGS

Substantially higher residues have been reported on a number of commodities which are animal feed items. Residue data are still unavailable for maximum registered uses of corn, soybeans, and peanuts, which are major animal feed items. We note that Monsanto indicated plans to request increased tolerances for peanut forage and hay. These were not considered as feed items for the purposes of the Special Review and are likely to have a substantial effect on the residue estimates in meat and poultry products. Several different scenarios are being considered.

Additionally, a Monsanto submission has been recently received, which may resolve some of the data deficiencies. Meat, milk, poultry, and eggs will be discussed in a separate memo, along with review of the aforementioned submission.

CONCLUSIONS

1. The nature of the residue in plants is adequately understood. The residue of concern is alachlor and its metabolites containing the DEA and HEEA moieties. The nature of the residue in ruminants and poultry is not adequately understood. Deficiencies are discussed in our memo of 11/1/85 (M. Loftus, Accession No. 257285, RCB No. 1009). These deficiencies need to be resolved.

2. Analytical methods submitted by Monsanto which require the use of custom made glassware which is not commercially available are not suitable for enforcement purposes. These methods also have a large range of recoveries and a low average recovery. The Monsanto method for peanut commodities, Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Methoxyethyl)-6-Ethylaniline (MEEA) Yielding Alachlor Metabolites in Peanut Hay, Vines, Hulls, and Nutmeats," Appendix D of MSL-5718 and MSL-4636 (Accession No. 263022), may be suitable for enforcement purposes and is being recommended for an MTO.

2a. To date, Monsanto has not submitted data on the applicability of the PAM Multiresidue Methodology to detect alachlor and its metabolites. This requirement was published

in the Federal Register on September, 26, 1986 (51 FR 34249), and appears in 40 CFR 158.125. Copies of the Federal Register Notice and the 4 Multiresidue protocols are attached to this review. These data are required.

3. Additional information is needed on the analytical methods used for the storage stability data on soybean grain. If this information were provided, we could conclude that residues of alachlor DEA and HEEA metabolites are stable in oil crops stored up to one year. We note, however, that many studies had oil crop samples stored several years. Adequate storage stability data are available for alachlor DEA metabolites in forage crops stored up to 3 years (translated from acetochlor MEA metabolites). Storage stability data are still needed for HEEA metabolites of alachlor. Storage stability data are also needed for DEA and HEEA metabolites of alachlor in animal tissues.

4. Monsanto submissions of residue data for alachlor are consistently lacking complete sample history (dates of fortification and analysis, length and conditions of sample storage) and sample chromatograms obtained when the samples were analyzed (not when the analytical method was validated). Often, no chromatograms of samples fortified at the limit of detection have been submitted.

5. Tentative estimates of maximum residues for the purpose of tolerance setting and best available estimates for the Special Review dietary exposure are tabulated below. Estimates are tentative due to lack of validation data, as described above in Conclusion 4; and due to uncertainty about the maximum use pattern to be supported. Tentative Registration Standard residue estimates are for a single application at 8 lb ai/A for corn and 4 lb ai/A for other crops. Tentative Registration Standard residue estimates for processed products are obtained by multiplying the tentative maximum residue estimate for the rac by the maximum concentration/reduction factor. Tentative Registration Standard residue estimates for peanut commodities after a single application at 8 lb ai/A are listed in footnote 2 of the table. Tentative Special Review residue estimates are based on the typical application rate of 4 lb ai/A for these commodities. Tentative Special Review residue estimates for processed commodities are obtained by multiplying the tentative maximum Special Review residue estimate for the rac by the average concentration/reduction factor. Data from the use of the microencapsulated formulation (Lasso Microtech) were not used when Lasso Microtech was not registered for use on that crop. Deficiencies outlined below in the following conclusions must be corrected, as well as conclusions in our summary review of 1/30/87. These

estimates will be updated as more residue data and validation data become available.

SUMMARY TABLE
TENTATIVE RESIDUE ESTIMATES (PPM ALACHLOR EQUIVALENTS)

Crop	Estimates based on Maximum Residue found in Field Trials at Maximum Use Pattern	Estimates based on Maximum Residue found in Field Trials at Typical Use Pattern	Estimate Adjusted for % Crop Treated
Corn			
grain	0.019	0.016	0.0056
K+CWHR	0.005	0.005	0.0018
forage	0.60	0.60	0.21
fodder&stover	0.20	0.20	0.07
meal	0.021	0.015	0.0052
(soapstock)1/	0.048	0.029	0.010
crude oil	0.076	0.042	0.015
refined oil	0.003	0.0019	0.0007
Peanuts2/			
nuts	0.27	0.27	0.17
hulls	0.9	0.9	0.56
meal	0.49	0.37	0.23
soapstock	0.13	0.05	0.031
crude oil	0.23	0.10	0.062
refined oil	0.04	0.02	0.012
forage	3.4	3.4	2.1
vines	3.4	3.4	2.1
Soybeans			
grain	0.21	0.21	0.044
hulls	0.32	0.32	0.067
meal	0.36	0.26	0.055
refined oil3/	0.05	0.04	0.008
protein concentrates	0.08	0.07	0.015
protein isolates	0.05	0.04	0.008
soapstock	0.52	0.38	0.080
forage	2.6	2.6	0.55
hay	2.0	2.0	0.42
Sorghum			
grain	0.035	0.035	0.0028
forage	1.4	1.4	0.11
fodder&stover	0.65	0.65	0.052

SUMMARY TABLE, CONTINUED
TENTATIVE RESIDUE ESTIMATES (PPM ALACHLOR EQUIVALENTS)

Crop	Estimates based on Maximum Residue found in Field Trials at Maximum Use Pattern	Estimates based on Maximum Residue found in Field Trials at Typical Use Pattern	Estimate Adjusted for % Crop Treated
Legumes			
bean/pea forage4/	2.6	2.6	0.39
bean/pea hay4/	4.6	4.6	0.97
pea seeds	0.03	0.03	0.0009
lima bean seeds	0.03	0.03	0.0042
dry bean seeds	0.21	0.21	0.032
dry pea seeds	0.12	0.12	0.0036
peas w/ pods4/	0.27	0.27	0.008
lima beans w/pods4/	0.21	0.21	0.029
Sunflowers			
sunflower seeds	0.83	0.83	0.016
meal w/hulls	1.16	1.06	0.021
crude oil	0.23	0.17	0.0034
Cotton			
cottonseed	<0.02	<0.02	0.0002

1/ not regulated
2/ If 8 lb ai/A single application for use on peanuts is to remain registered under Section 24(c), then maximum residues are tentatively estimated at 0.87 ppm in peanuts, 2.7 ppm in peanut hulls, 4.8 ppm in peanut hay, and 12 ppm in peanut vines
3/ refined, deodorized oil for human consumption
4/ estimated from earlier residue data where only DEA metabolites of alachlor were measured

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5a. We previously concluded that the residue data on legumes would not be adequate if the protocol were followed, (See our review of the protocol for this study, M. Loftus, 4/18/86). We concluded that the proposed number of samples (1 from each geographical area) was inadequate. We concluded that the proposed geographical representation was inadequate. We stated that data for each type of application are needed from each geographical area.

5b. Additional residue data for each type of application to dry beans are needed from ID, CO, and NE. (Residue data are needed for each type of application to dry beans in ND, MI, WI, IL, CA, ID, CO, and NE at the maximum registered application rate.)

5c. To expand the use of alachlor to snap beans or to obtain a group tolerance for legumes (except soybeans), residue data are also needed for both types of applications at the maximum proposed application rate to snap beans in NJ/NY, TN/NC/VA, CA, and FL.

5d. The complete sample history from harvest until analysis was not included in the submission on legumes. Information on the type of application (ground broadcast, etc.) was not submitted. The dates the crops were treated, the weather conditions, and the date harvested were not included in the submission. The date and method of shipping and the length and conditions of storage from harvest until analysis were not submitted. The dates of analysis were not submitted. All of this information is needed for review of the submitted residue data.

5e. Bean and pea seeds were analyzed without pods. The rac is the succulent pea or bean with pod and the dry bean seed without pod. Additional data are needed for succulent beans and peas with pods. We note that the tolerance was originally established for peas with pods removed. However, the tolerance for peas needs to be revised, since the rac is peas with pods. We did, however, estimate residues on succulent beans and peas with pods, by using previously submitted residue data where DEA metabolites were measured and the % DEA metabolites in forage of legumes.

5f. No residue data have been submitted to support the 24(c) use on peanuts at layby. According to 40 CFR 162.154 (b)(1)(ii), the Administrator may disapprove a State Registration at any time if the Administrator determines that the use may result in a residue on food or feed exceeding or not covered by a tolerance, exemption, or other clearance under FFDCA. Accordingly, we recommend that the 24(c) registration for the use of alachlor on peanuts at layby be disapproved at this time.

5g. For peanut commodities, no chromatograms were submitted for samples fortified at the claimed LOQ, except for peanut soapstock. Other chromatograms submitted with the analytical method were from samples fortified at 0.020 ppm. None of the chromatograms were dated. Dates of analysis are needed. It is not clear if the chromatograms included with the analytical method were from samples whose analyses were included in the report.

5h. Figures for peanut protein concentrates and isolates were included in the table of residue estimates, although it is unclear if these peanut processed fractions are used in the United States to any great extent.

5i. Most of the sample history for the sunflower seed samples is missing from the report. There is no indication of the type of treatment made, the method of application, (ground or aerial, broadcast or banded, etc.), dates of harvest, dates and conditions of storage of samples, etc. This information is needed for review.

5j. The chromatograms submitted with the sunflower seed analytical method appear to correspond to samples analyzed for the sunflower seed report. However, the chromatograms are not dated. Dates of analysis are needed. Additionally, only chromatograms of sunflower seed meal with hulls are fortified at the limit of quantitation. Additional chromatograms are needed of sunflower seeds and sunflower seed oil fortified at the limit of quantitation. The complete sample history is needed for each sample from the time of application and planting until analysis.

5k. Processing data are still needed for sunflower meal and hulls (separately). The registrant may want to submit data for refined sunflower oil since residues are likely to decrease with refining. The Registration Standard due date for this study was 12/86.

5l. We await the submission of the final report for the Cottonseed study. The Registration Standard due date for this study was 12/86.

5m. Data on cotton forage samples were not submitted and are needed. Alternatively, a feeding restriction may be placed on the label. The PM should take appropriate action regarding the non-submittal of these data.

5n. We question the validity of the cottonseed study, since none of the samples were apparently frozen until well after harvest, and storage stability data are not available for the conditions under which the cottonseed samples were stored. Additional residue data reflecting adequate geographical representation will be needed.

5o. No residue data on corn were included in this submission. Data have not been submitted for any post emergence application where DEA and HEEA metabolites were measured. Data on the early post emergence use (before the corn is 5" high) and including sequential applications were required by the Registration Standard and have not been submitted. The PM should take appropriate action regarding the non-submittal of these data.

5p. No residue data have been submitted for the post emergence directed layby application to corn (24(c) use), where both DEA and HEEA metabolites of alachlor were measured. Previously submitted residue data showed over-tolerance residues of alachlor DEA metabolites in corn forage and fodder (1.92 ppm in one location (which may be considered anomalous) and up to 0.28 ppm in other locations, after correction for recovery). Very few locations were included in the studies. Residues in corn grain in these studies were non detectable (<0.05 ppm DEA metabolites). The label contains an impractical feeding restriction, "[d]o not graze or feed treated forage to livestock following application." Feeding restrictions on corn forage and fodder are impractical because these commodities are not under grower control (except for pop corn and sweet corn).

According to 40 CFR 162.154 (b)(1)(ii), the Administrator may disapprove a State Registration at any time if the Administrator determines that the use may result in a residue on food or feed exceeding or not covered by a tolerance, exemption, or other clearance under FFDCA. Accordingly, we recommend that the 24(c) registration for the use of alachlor on corn at layby be disapproved at this time.

5q. Deficiencies in previously submitted corn residue data have not been resolved. See S. Hummel review of 1/30/87.

5r. No residue data on soybeans were included in this submission. Residue data have not been submitted for any post emergence application where both DEA and HEEA metabolites were measured. Data are needed for the post emergence application to soybeans alone, and for sequential applications including a post emergence application. These data were required by the Registration Standard. The PM should take appropriate action regarding the non-submittal of these data.

5s. Deficiencies in previously submitted soybean residue data have not been resolved. See S. Hummel review of 1/30/87.

5t. No residue data on sorghum were included in this submission. A processing study for sorghum has not been submitted. Processed products of sorghum are flour and starch. Although these data were required by the Registration Standard, the required data may be translated from corn dry milled processed fractions when data on corn dry milled processed products are received.

5u. Deficiencies in previously submitted sorghum residue data have not been resolved. See S. Hummel review of 1/30/87.

6. Residues in meat, milk, poultry, and eggs are being considered in a separate memo. Substantially higher residues have been reported on a number of commodities which are animal feed items. Residue data are still unavailable for maximum registered uses of corn, soybeans, and peanuts, which are major animal feed items. We note that Monsanto indicated plans to request increased tolerances for peanut forage and hay. These were not considered as feed items for the purposes of the Special Review and are likely to have a substantial effect on the residue estimates in meat and poultry products.

Additionally, a Monsanto submission has been recently received, which may resolve some of the data deficiencies. Meat, milk, poultry, and eggs will be discussed in a separate memo, along with review of the aforementioned submission.

RECOMMENDATIONS

We recommend that the registrant be informed of these deficiencies and advised to correct them. We recommend that our entire review be forwarded to the registrant.

We recommend that the PM take appropriate action regarding the non-submittal of the post emergence residue data on corn and soybeans (including sequential applications).

We recommend that the 24(c) registrations for layby applications on corn and peanuts be disapproved at this time due to the possibility of over tolerance residues.

cc: R. F., circu, S. Hummel, alachlor S.F., Alachlor S.R.F., TOX, G. Burin (SIS), PMSD/ISB
RDI:EZ:06/11/87:RDS:06/12/87
TS-769:RCB:SVH:svh:RM810:CM#2:06/12/87